

## SEXUAL DIFFERENCES IN THE SKULL

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MORE than a year ago one of us worked out the average contours of 30 male and 30 female, eighteenth century, skulls from the Clare Market district, though there was then no time to work out or call attention to the sexual points of difference between them.

As a matter of fact there was no way of being sure how far they were rightly sexed because few anatomists have the chance of testing their capabilities in this way on a series of skulls of known sex.

Still we propose to take the two series of tracings as a starting point and to see whether any of the differences between them are repeated in other series.

In the first place, on comparing the two norma verticalis tracings (fig. 3), it is evident that the female skull is shorter and broader in proportion than is the male, and it is no surprise to find that its cranial index is 77.5 while that of the male is 75.5. As it is obviously an important point to settle whether any definite allowance should be made for sex in comparing different groups of skulls we looked up the records of the other series of English skulls lately measured and found them as follows:

Hythe	♂ 79.9	♀ 81.9
Rothwell	♂ 76.3	♀ 75.8
Moorfields	♂ 75.5	♀ 75.0
Whitechapel	♂ 74.3	♀ 73.1

The results of this investigation were not very encouraging; Hythe showed the same preponderance of 2 per cent. in the female index noticed in the Clare Market series, but in the other three groups the males had a larger index than the females. We felt therefore that it was essential to get some material where the sexing was not the arbitrary work of an expert whose personal equation was unknown, even to himself, and we turned to the records of Anglo-Saxons because, as they are generally buried with male or female weapons and ornaments, there is much less chance of mistaking the sex than in later English burials.

22 male Saxons gave us an index of 74.3, and 23 females one of 75.3.

Later on, Dr Duckworth of Cambridge helped us very much by sending us records of 160 bodies from the dissecting room on which both the head

and the skull measurements had been taken and in which, of course, there was no doubt of the sex.

The cranial index of 120 male skulls was 75·8 and of 40 female 78·2.

As we were unable to get any more series the sex of which was definitely known except the series of soldiers at Millbank in which there were no females for comparison, we had recourse to the living head and measured 150 male medical students at St Thomas's Hospital and 150 female students at the Medical School for Women.

This, of course, brought us up against the allowance which it is necessary to make for the soft parts in comparing the living head with the bare skull.

Until lately craniologists have followed the example of Miss Lee in allowing 11 mm. for these, but Dr Gladstone found that a little over 7 mm. was sufficient, while Dr J. H. Anderson suggested 9 mm.

Our method of testing the thickness of the covering tissues was to run a needle through a thin disc of cork, the needle was then stuck into the scalp until it touched the bone, when the cork was moved down to the skin; then the needle was withdrawn and the distance between the cork and its point measured.

This method was so simple that a large number of records could be obtained in London post-mortem rooms in a short time and we soon had ample evidence that 8 mm. was a good allowance for the soft parts in both the length and breadth of the skull. This is the more satisfactory in that it is midway between Gladstone's and Anderson's results.

With regard to height, it is not enough to allow for the thickness of the tissues on the vertex and in the roof of the external auditory meatus, because in a dried skull the ear plugs of the auricular craniometer are in quite a different position to that they occupy with the soft parts in place; they are much nearer together in the skull and the removal of the soft parts may merely allow them to approach one another while their centres still occupy the centre of the canal. Another point which has to be taken into account is that the cartilaginous meatus is rising as it passes inward.

In practice we found that scraping the soft parts out of the bony meatus until the plugs could occupy the position they would take in the dried skull made a difference on the average of 1·5 mm. and this we attributed largely to the slope of the meatus. We would therefore suggest allowing 5·5 mm. for the difference in height between the living head and the dried skull, 4 mm. for the scalp and 1·5 for the meatus. This is rather less than Anderson suggests but is somewhere very near the average.

In practice it will be found that the change from the cranial to the cephalic index means an addition of 1 per cent.

Another comparison available was between the male and female patients in St Thomas's Hospital whom we may regard as representative of the modern migratory Londoner of the lower and lower middle class, while a still further one was between the male and female visitors to the British Association's

meetings as quoted by Dr Macdonell. These probably would represent pretty much the same class of society as the male and female medical students; that is to say, perfectly nourished individuals interested in intellectual occupations.

If we now tabulate the results of these (with the possible exception of the Anglo-Saxons) definitely sexed series we get the following:

					Excess of ♀ index	
Anglo-Saxons	♂	(22)	75.9	♀	(23) 76.3	0.4 per cent.
London Medical Students	♂	(150)	78.7	♀	(150) 79.5	0.8 „
Cambridge Dissecting Room	♂	(120)	78.01	♀	(40) 79.6	1.6 „
London Patients	♂	(50)	77.7	♀	(50) 79.3	1.6 „

It seems therefore that all the material which has not been subjected to arbitrary sexing agrees in giving the female heads a higher index than the male by about 1 per cent., and if this ratio should be confirmed in the future we may have in it a useful method of checking the correctness of our endeavours in sexing unknown collections of skulls<sup>1</sup>.

The next point is to determine whether the female skull has increased its index by decreasing its length or increasing its breadth in proportion to the male and for this the length and breadth averages are necessary.

		L.	Br.	L.	Br.	
London Med. Students	♂	193.4	152.3	♀	185	147
British Association	♂	198.1	155	♀	185.6	148.3
Cambridge Dissecting Room	♂	194.3	151.5	♀	186	148
London Patients	♂	193.3	150	♀	182.4	144.7
Clare Market	♂	196	150	♀	186	146

In other words, among the London Medical Students the length of the ♀ head is 95.1 per cent. of that of the male while the breadth is 96.5 per cent.

In the British Association	length is	93.7 per cent.
„ „	breadth is	95.7 „
In the Cambridge Anatomy School	length is	95.7 „
„ „	breadth is	97.7 „
In the London Patients	length is	94.4 „
„ „	breadth is	96.5 „

It will therefore be seen that in all these separate groups the ratio of the breadth of the female is 2 per cent. nearer that of the male than is the length, or, in other words, that there is a 2 per cent. greater loss of length than of breadth in the female English skull compared with the male.

Having traced the sexual difference to the length it naturally became a question whether it might not be accounted for by the greater development of the frontal sinuses in the male and the only means of checking this which occurred to us was to take the ophryo-maximal measurements and see whether

<sup>1</sup> Since writing the above we are interested to note that Fleure and James found the same increase of the cephalic index in the female sex in Wales. *Journ. Anthropol. Inst.* 1916, p. 48.

there was the same proportional difference between the sexes that was noticed in the glabello-maximal; the argument being that, as the ophryo-maximal length only affects the brain containing part of the skull while the glabello-maximal represents brain and air, any difference in the proportion of the two lengths to the breadth must be due to a difference in the air containing part.

In the large series of skulls at Hythe which one of us measured (*Journ. of Anthropol. Inst.* vol. XXXVIII. p. 419) it was found that the difference between these two lengths was, on an average, 2 mm. for male skulls and nothing at all

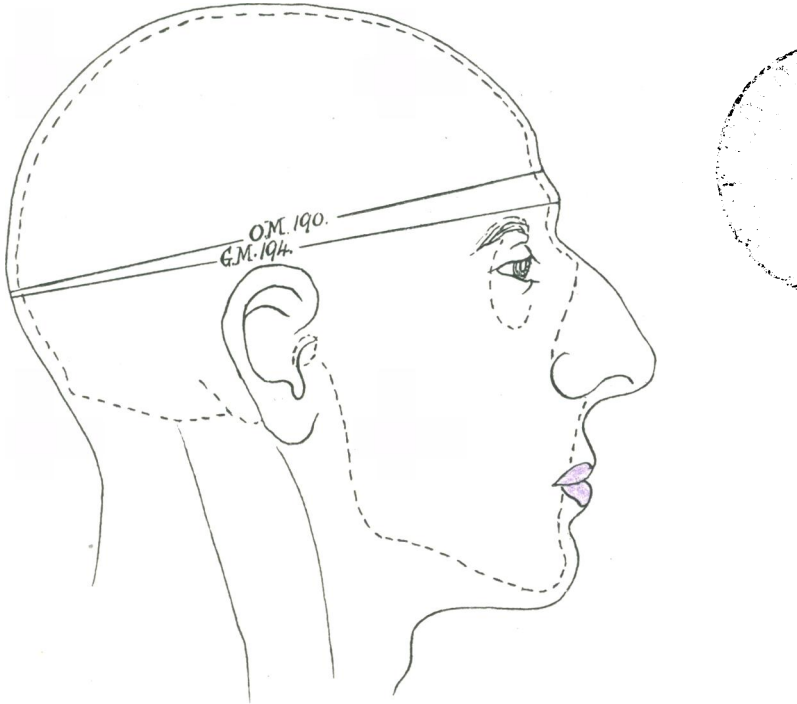


Fig. 1.

for the female. We have repeated the measurements on 100 patients in St Thomas's Hospital, 50 males and 50 females, with the same result.

Assuming that this difference is approximately accurate, we find that, if we deduct 2 mm. from the glabello-maximal length of the 150 St Thomas's Hospital male students' heads, the length of the 150 Women's School students is 96.65 per cent. of the St Thomas's length and the breadth 96.5 per cent. In other words that the female heads were 3.5 per cent. smaller than the male in both the antero-posterior and transverse diameter. This is exactly what we were looking for because on removing the 2 mm. due to air, the proportions between length and breadth become the same in the two sexes and so the cephalic index becomes the same.

When we came to the other series, however, the results were not so satisfactory from this point of view, but the simplest thing will be to tabulate the four sets of results.

	♀ shorter than ♂	♀ narrower than ♂
London Medical Students	3.5 per cent.	3.5 per cent.
London Hospital Patients	4.5    ,,	3.5    ,,
Cambridge Dissecting Room	3.3    ,,	2.3    ,,
British Association	5.4    ,,	4.3    ,,

From this it appears that the subtraction of 2 mm. from the male length does not equalize the proportions of length and breadth except in one series out of four. The other three agree in requiring another 1 per cent. removed from the male in order to equalize the cephalic index in the two sexes.

The amount is not great, but it is worth noticing, and our available material makes us think that the average English female skull is slightly broader, in proportion to its length, than the male even when the increased size of the air sinuses in the latter is allowed for.

One has, of course, to think whether there is any reason why the medical students should not have fallen into line with the other series, and the only one we can suggest is that they were all young adults in whom, perhaps, the sinuses were not as well developed as in the older groups.

#### *On Checking the Sexing of Skulls*

As all the different series of skulls in which the males and females were known agree in showing the female head as 2 per cent. broader than the male in relation to its length it appears that we have a check on the accuracy of the arbitrary sexing of those large series in which the sexes are not known.

Judged in this way the following results are interesting:

	♀ index > ♂	♀ index < ♂
(30 ♂ 30 ♀) Clare Market	2 per cent.	
Hythe	1.5    ,,	
Moorfields		.6 per cent.
Whitechapel		.3    ,,
Rothwell		.5    ,,

The Clare Market and Hythe series therefore answer our expectations well enough, but the other three show the reputed males with a higher cephalic index than the females, a condition of things which is not in harmony with the evidence at present before us and makes us regard their accurate sexing as probably not very happy.

#### *The Facial Index*

On comparing the norma facialis tracings of the two sexes in the Clare Market series it will be seen that the males have an average length of 121 mm. from the nasion to the lower chin level against 116 mm. in the females while the greatest bizygomatic breadth is 129 mm. in the males against 123 mm. in the females. This means that the proportion of the length to the

breadth of the face or facial index is 93.8 in the male against 94.3 in the female. This, of course, is in the dried skull and we do not know any other collection of skulls, either accurately or tentatively sexed, with which to compare this because in all the collections we know the lower jaws are missing. We are, therefore, thrown back upon living faces with all the difficulties of adequate allowance for soft parts.

After careful examination of sections of faces we suggest 8 mm. as an ample allowance for the soft parts in the breadth and 4 for those in the length, and this would make the living Clare Market index 91.2 for the males and 91.6 for the females.

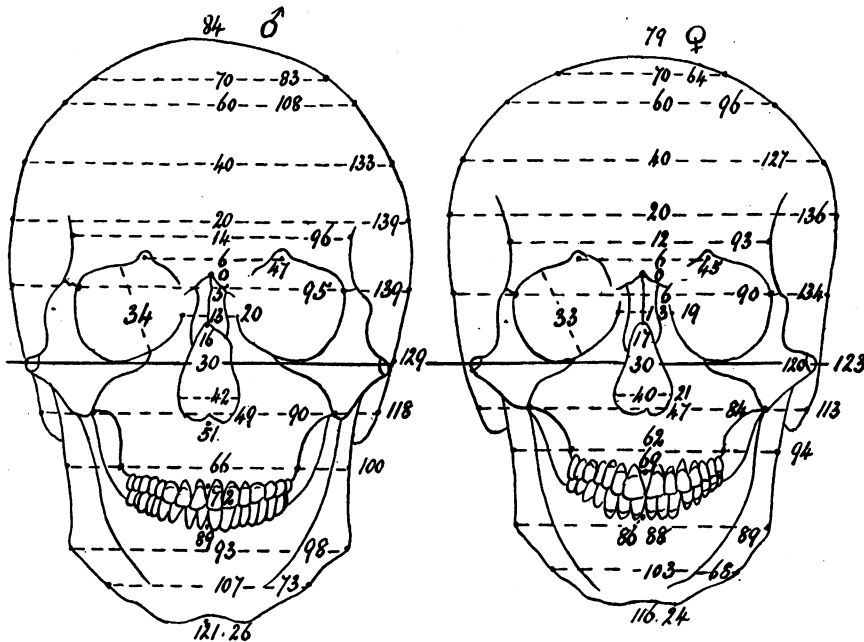


Fig. 2.

Against this we have to set 53 male students of St Thomas's Hospital with an index of 870 and 100 female students from the Women's School with one of 863, which means that while the Clare Market female facial index is practically equal to the male, the living female students' index is 99.2 that of the male students.

This makes us doubt whether any use can be made of the facial index for sexing purposes, and our work, so far, is negative from this point of view.

#### *The Breadth-height Index*

The difference in the appearance of the cranial vault is rather striking when the norma facialis of the two sexes is viewed side by side and suggests a difference in the breadth-height index. If this index is to be checked in the living head it will be necessary to use the auricular height which may be

ascertained by taking the height of the vertex above the Frankfurt plane and adding 6 for half the external auditory meatus.

This gives 120 mm. for the males and 115 for the females, and, when the maximal breadth is divided by it, the index is 84.5 ♂ and 83.3 ♀. This difference in the index means that the female skull has lost 4.2 per cent. of the male height but only 2.8 of the male width.

At present we have little material definitely sexed with which to compare this, but as far as 103 male and 25 female medical students go we find the proportion is the same because the male breadth-height index is 89.3 and the female 88.2.

This is the cranial index, not the cephalic, obtained after deduction of 8 mm. from the breadth and 5.5 mm. from the height.

#### *Bimolar Width*

Professor Keith has lately called attention to the diminution in the width of the palate in modern English compared with Saxon skulls; here we are only concerned with sex and it is striking how much narrower the female palate is than the male. The distance between the maxillary tuberosities in the males is 62 mm. while in the females it is 54 mm., and it will be noticed that the same line which joins the tuberosities is continued on to the lower jaw. In the maxillary width the female skull is 8 mm. narrower than the male, but in the wider mandibular width in the same line the female is only 6 mm. less than the male. Unfortunately we are unable to check this record at present on certainly sexed material.

#### *Zygomatic Width*

The Bizygomatic width or face breadth has been considered already in connection with the facial index and we now wish to consider it from the *norma verticalis* in connection with the width of the cranium.

In looking at this *norma* it is evident that the male skull is a good deal more phaenozygous than the female and the question arises whether the zygomata are more splayed in the male or whether the vault of the skull is fuller in the female in the anterior part of the temporal fossa. We shall probably get a better idea of this if we compare the bizygomatic width with the maximal skull breadth rather than with the inter-stephanic width.

If we do this we find that the zygomatico-maximal index or proportion of the zygomatic width to the maximal width is 90.9 per cent. in the male, and 87.0 per cent. in the female. This indicates that the zygomatic arch is distinctly wider in relation to the skull width in the male than in the female. We were able to check this in the male and female medical students in whom the male index was 89.7 per cent. and the female 88.5 per cent. These observations were made on 53 male and 100 female students.

#### *Apparent tapering forward of the Skull*

Apart from the difference in zygomatic width the male skull appears to taper away in the anterior temporal region much more than the female does;

in other words that the pterionic region in the female is fuller than in the male. A useful measurement is to our hand in the breadth taken a quarter of the way back along the length of the skull. This in the male is 115 and in the female 112. Contrasting these with the maximal width we get an index of 81 in the male and of 81.2 in the female.

This index suggests that the appearance of fulness is illusory and due to the feeble development of the zygomata in the female.

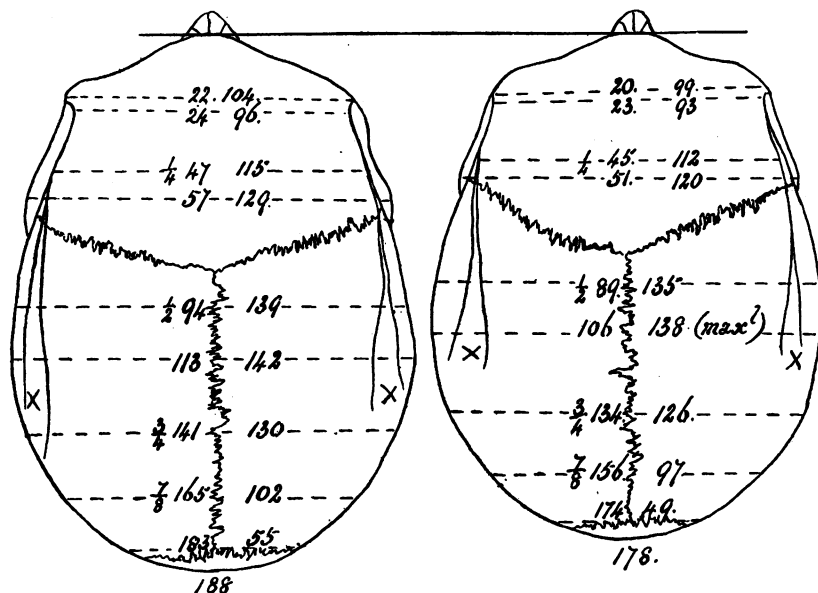


Fig. 3.

### CONCLUSIONS

From the material at present at our disposal we have come to the following conclusions about the English skull.

1. That the female skull is shorter in proportion to its breadth than is the male by 2 per cent. and that this difference is not fully accounted for by the greater development of the frontal sinuses in the male.
2. That in those series of artificially sexed skulls in which this proportion is markedly departed from the sexing has probably been unsuccessful.
3. That the facial index does not differ in the two sexes.
4. That the female skull is lower in proportion to its width than the male, by from one to two per cent. when the auricular height is taken.
5. That the female skull is some 8 mm. narrower in the width of the palate than the male.
6. That the zygomatic arches are wider in proportion to the maximal breadth of the skull by 4 per cent. in the male than in the female.